agri-fax Alberta AGRICULTURE

Agdex 127/15-4

March, 1989

Grass Seed Production Under Irrigation

There is strong producer interest in grass seed production as a high income crop option in irrigated areas. New producers, however, should be cautious; establishing a stand takes time, money and management expertise. The supply-demand situation of any grass seed may change by the time the first seed crop is harvested.

This publication provides some basic information for those contemplating irrigated grass seed production.

The advantages of growing grass seed are:

- soil organic matter may be increased, resulting in higher fertility and decreasing the potential for soil erosion.
- grass roots improve soil structure and allow for more rapid water penetration.
- grass grown for seed requires less water than most annual crops.
- harvest residue and the stand itself can provide supplemental livestock feed.
- established stands have a low labor requirement.
- harvesting usually occurs during periods of favorable weather and before cereals and oilseeds must be harvested.
- grasses are useful as "break" crops in rotations with broadleaf crops because they deter the buildup of certain diseases and weed species.
- diversified cropping reduces the risk associated with the possibility of a price collapse of a main cereal or oilseed crop.

It takes at least two years to establish a stand and harvest the first seed crop. It is desirable to have a marketing plan or a production contract with a commercial seed company before establishing a seed field.

The following suggestions will allow a new producer to improve his chances for success and become familiar with the requirements of grass seed production before making a substantial commitment to this kind of enterprise.

- start small, perhaps with a field of about 10 acres
- choose a grass adapted to the area
- choose a grass that is in demand
- choose a grass that is easily established
- choose a grass with high seed yield potential
- choose a grass that is easy to maintain and harvest
- plant high quality seed

Each grass species has unique characteristics that will determine management choices to maximize seed production.

Species Selection

There are many cool-season grasses that may be considered for seed production in the irrigated areas of Alberta. They are: meadow and smooth brome grass, Kentucky blue grass, tall fescue, timothy, wheatgrasses (crested, intermediate, pubescent, slender, and tall), and Russian wild rye. Orchard grass and perennial rye grass have potential, but their winter survival is not consistent (table 1).

Site History And Selection

It is very important to know the cropping history and associated cultural practices of the site. Residual effects of some previously applied herbicides may seriously affect grass seedlings.

Copies of this and related publications may be obtained from the Print Media Branch, Alberta Agriculture, 7000 - 113 Street, Edmonton T6H 5T6 or Alberta Agriculture's District Offices.

Table 1. Agronomic Characteristics of Various Grasses

	Growth type	Seed shatter potential	Winter hardiness	Drought	Tolerance Acidity	Salinity	Soil adaptability
Kentucky blue grass	sod	low	good	no	no	no	Fertile, moist, well-drained soils
Meadow brome grass	bunch	low	excellent	fair	fair	fair	Any type but best on loams and sandy soils
Smooth brome grass	sod	low	excellent	fair	fair	fair	Any type but best on loams and sandy soils
Tall fescue	bunch	medium	fair	yes	yes	yes	Variety of soils, does well on wet, poorly drained soils
Orchard grass	bunch	medium	fair	fair	yes	no	Sandy loams and clays, requires good drainage
Perennial rye grass	bunch	medium	fair	no	--	--	Wide range of soils, best on well-drained medium-to-high fertility soils
Timothy	bunch	high	good	no	yes	no	Wide range of soils, best on moist clay, silty and sandy soils
Crested wheatgrass	bunch	low	excellent	yes	fair	fair	Wide range of soils, does well on heavy clay and sandy soils
Intermediate wheatgrass	sod	low	good	yes	fair	no	Best on well-drained, fertile soils
Pubescent wheatgrass	sod	low	good	fair	fair	fair	Best on well-drained, fertile soils
Slender wheatgrass	bunch	medium	good	yes	fair	yes	Wide range of soils, best on sandy loams
Tall wheatgrass	bunch	low	good	no	fair	yes	Irrigated and subirrigated saline soils and poorly drained alkali soils
Russian wild rye	bunch	high	excellent	yes	fair	yes	Well drained, loam and clay soils

Some previous crops and persistent weed species may become a serious weed problem and reduce seed yield and quality. Consult the Canadian Seed Growers' Association Circular No. 6--*Regulations and Procedures for Pedigreed Seed Crop Production*--for isolation requirements of the different grass species.

When selecting a site:

- choose a site that is level to gently sloping to minimize run-off and water erosion, especially in wide-seeded rows
- avoid areas that may be contaminated with weed seeds by run-off water
- avoid rocky fields
- control weeds before planting

Weed infestations may be a problem in irrigated areas. The field must be free from perennial grass and broadleaf weed infestations such as quack grass, foxtail barley, Canada thistle and sow thistle, and annual grassy weeds including downy brome, green foxtail and wild oats. These weeds compete with the stand and their seeds are difficult to remove during cleaning of the seed crop.

Seedbed Preparation

Use a soil test to determine nutrient requirements and apply the fertilizer by working it in before packing the seedbed.

A fine, firm seedbed is the key to successful grass stand establishment. A cultipacker, harrows or an empty press drill can be used to prepare and firm up the seedbed. When properly done, tractor tire marks will be barely visible. A firm seedbed is necessary to achieve a shallow, uniform seeding depth and to ensure that the seed is in close contact with moist soil for rapid germination and early seedling root growth.

Stand Establishment

Use an ordinary seed drill equipped with press wheels and a grass seeder attachment.

Seeding dates

All perennial grasses require the equivalent of one season's growth before producing seed. Cool-season grasses generally establish better when seeded earlier in the season, but the time of seeding will depend on the following factors:

- availability of soil moisture for germination and early seedling growth
- when soil temperatures reach 4°-7°C
- completion of weed control measures

Most grasses can also be seeded from mid-August to September 1. Allow enough time so that at least three to five leaves can develop before fall dormancy occurs.

Table 2. Seeding Guidelines for Grass Seed Production

	Row spacing		Depth		Rate
	cm	(in.)	cm	(in.)	kg/ha = lb/ac
Kentucky blue grass	30	(12)	0.5-1.3	(1/4-1/2)	1-4
Meadow brome grass	60	(24)	2.0-2.5	(3/4-1)	3-4
Smooth brome grass	60	(24)	2.0-2.5	(3/4-1)	2-3
Tall fescue	30	(12)	1.3-2.5	(1/2-1)	4-6
Orchard grass	30	(12)	1.3-2.5	(1/2-1)	4-6
Perennial rye grass	30	(12)	1.3-2.5	(1/2-1)	6-8
Timothy	30	(12)	0.5-1.3	(1/4-1/2)	2-3
Crested wheatgrass	60-90	(24-36)	1.3-2.5	(1/2-1)	2-3
Intermediate wheatgrass	30-60	(12-24)	1.3-2.5	(1/2-1)	2-3
Pubescent wheatgrass	30-60	(12-24)	1.3-2.5	(1/2-1)	2-3
Slender wheatgrass	30	(12)	1.3-2.5	(1/2-1)	2-3
Tall wheatgrass	30	(12)	1.3-2.5	(1/2-1)	10-15
Russian wild rye	75-90	(32-36)	2.0-2.5	(3/4-1)	2-3

Seeding rate

Seeding rates will vary according to the grass species and the row width used (table 2).

Seeding depth

Seeding depth is determined by seed size and soil texture. Grass seed should never be planted deeper than 2.5 cm (1 in.). Small seeded grasses such as blue grass and timothy should be seeded from 0.5-1.3 cm (¼-½ in.) deep. Larger-seeded grasses such as brome grass and the wheatgrasses can be seeded from 1.3-2.5 cm (½-1 in.) deep. Use the deeper depths on light textured sandy soils (table 2).

Row spacing

Row seeding produces higher seed yields than solid seeding. Spacing varies according to the species seeded, the moisture availability and machinery capabilities. Advantages to row seeding are that less seed is required for seeding and weed control is easier.

Companion crops

Companion crops are not generally recommended for grass seed production. Grass seedlings are not very competitive and companion crops delay grass stand development and reduce first- year seed yields. If a companion crop is used, choose a crop that is the least competitive with grass seedlings such as flax.

Fertilization

Fertilizer is not generally required on summerfallow fields or on high fertility soils until after the first seed harvest. Soil tests should be taken to determine the nutrient status of the field. There is some evidence indicating that inadequate levels of phosphorus and potassium may inhibit the response of grass to nitrogen. If phosphorus and potassium are required, apply a sufficient amount before seeding to provide adequate nutrients to last the expected life of the stand. Grasses require high amounts of nitrogen (N) fertilizer for seed production. On low fertility soils, up to 50 kg/ha (50 lb/ac) of actual N can be applied before seeding and an additional 50 kg/ha (50 lb/ac) of N in the late fall after dormancy. Do not apply fertilizer with the seed at planting time because it may damage the seed, which will affect germination.

Irrigation

Frequent, light sprinkler irrigations during establishment will ensure that adequate moisture is available for germination and early seedling growth and will also help to reduce soil crusting. During periods of high evaporation, irrigation intervals of 3 to 4 days may be required until the grass is 10 cm (4 in.) high after which the intervals can be longer. In general, flood irrigation is not used when a stand is being established. Total moisture consumption, including precipitation, until the end of August is expected to be from 55 to 65 cm (22-25 in.). Soil moisture should be maintained at or above 50 per cent field capacity. Light, frequent irrigations are recommended on light soils or sloping land.

Weed control

Weed Control is essential to the successful establishment of a grass stand. Methods of control include cultivation, mowing, herbicides and roguing.

Before seeding, a shallow cultivation with harrows will control some weeds. Cultivate when emerging grass seedlings become visible. Use row shields to ensure that the small seedlings do not become covered. A disc can replace the cultivator shovel and be adjusted to pull soil away from the row. A cultivator shovel behind the disc will pull the soil back up to the row. Shallow cultivation of 2.5 to 4.0 cm (1-1½ in.) deep should be done only as required. Maintain a clean, tilled field border.

Mow perennial grasses around slough areas, shelterbelts, fence rows, drainage areas and roadsides to prevent seeds from contaminating the grass stand.

Several herbicides are available as an alternative to cultivation. Time of application is crucial to prevent reductions in future seed yields. Refer to the Alberta Agriculture publication *Weed Control in Forage Crops*, Agdex 120/640-1 for specific recommendations.

Removing off-type plants and weeds within rows will help reduce contamination and yield losses in succeeding years.

Fall maintenance

Under irrigation, substantial growth can result, especially with species such as brome grass and the wheatgrasses. The newly established grass stand should be clipped or swathed in preparation for winter. Leave stubble at least 15 cm (6 in.) high to trap snow. Remove harvested material from the field because it will affect seed yield the following

year. This material can be used for livestock feed. Once dormancy occurs, apply the necessary fertilizer to low fertility soils.

Stand Management During Seed Production Years

The major factors affecting seed yields are the timing and amount of irrigation; the timing and method of weed control; and soil fertility levels. These factors can all be controlled by the producer; but, the weather cannot be controlled, and extremes of high or low temperature during flowering may reduce seed yields no matter how good management is.

Irrigation

Early spring moisture is necessary for early vigorous stand growth. Irrigation is most important for seed production during the critical period that starts just before the flowering of the grass until pollination is completed. Inadequate moisture at this time will result in reduced seed yields. Irrigate at or before the boot stage and just before and after flowering. Irrigation frequency will depend on the grass species, soil type, temperature, rainfall and wind. From two to five irrigations may be needed to produce a seed crop. Sprinkler irrigation during flowering may reduce seed set and cause seed losses after ripening has started. Water penetration to 60 cm (24 in.) indicates an adequate amount of water has been applied. Established stands require less frequent irrigations than new seedings because water penetrates the soil more readily. Uniform irrigation will promote uniform seed ripening but too much soil moisture could delay seed maturity. Grass seed heads can exhibit different stages of maturity and sprinkler irrigating when the first seeds begin to ripen could result in seed losses by shattering. As soil moisture declines, grass seed matures rapidly, therefore the stage of seed maturity will have to be monitored because shattering can occur before the field can be harvested.

Weed control

Established grass stands that have been seeded in rows can be cultivated in the spring before active growth begins. Use spring toothed harrows on bunch grasses and double discs on sod-forming grasses. Cultivate about 2.5 cm (1 in.) deep to control winter annual weeds and volunteer grass growth. Cultivators such as a duck foot can be used to cultivate rows after the early spring cultivation. Cultivate only as needed and avoid throwing soil over the grass rows.

Herbicides can be used for weed control but there are critical times when they must not be used. Refer to Alberta Agriculture publication *Weed Control in Forage Crops*, Agdex 120/640-1 for detailed information. Remove off-type plants and grassy weeds from within the rows.

Fertilization

Fertilize grass seed stands in the fall. The time of application will vary with the species (table 3). Nitrogen levels may have to be increased to provide adequate nutrient levels because of increased growth under irrigation. On sandy soils where leaching is a problem, a split application of fertilizer in the fall and early spring may be more effective. As grass stands age and become sod bound, a nitrogen deficiency is more likely to occur and higher rates of nitrogen will be required.

Harvesting

Timing of the harvest is critical. Generally, grasses require about 30 days from flowering to seed maturity. This period will vary because flowering and seed development can last from several days to two weeks resulting in seed heads emerging at different times and not ripening uniformly. Hot, dry weather reduces ripening time and cool, moist conditions delay seed maturity. Due to a higher ash content in the grass plant under irrigation, grass seed heads shatter more readily than under dryland conditions. The ideal time to harvest is at the medium to hard dough stage (35-50% moisture). Most grasses will hold their seed from 10 to 15 days, but the time from medium dough to seed shatter can be as short as 3 to 4 days. Fields will have to be checked often to determine the status of seed maturity.

There are several methods of determining crop maturity:

- when seed heads are gently struck against the palm of the hand and seed shatters, harvest immediately
- when seed heads are roughly struck against the palm of the hand and seed shatters, the crop is ready to swath
- when 75 per cent of seed heads have matured - swath

Table 3. Fertilizer Requirements for Various Grasses

	Rate of N* kg/ha (lb/ac)	Time of application
Kentucky blue grass	60-100	Split application in late fall and very early spring
Meadow brome grass	40-80	September
Smooth brome grass	40-80	September
Tall fescue	60-90	Late fall
Orchard grass	80-120	Late fall
Perennial rye grass	50-100	Late fall
Timothy	100	Late fall or very early spring - 50 kg/ha (lb/ac) N before seeding unless on summerfallow
Crested wheatgrass	35-70	Late fall
Intermediate wheatgrass	60	Late fall or very early spring
Pubescent wheatgrass	60	Late fall or very early spring
Slender wheatgrass	60	Late fall or very early spring
Tall wheatgrass	60	Late fall or very early spring
Russian wild rye	100-200	Immediately after harvest

*If phosphorus or potassium are required, apply before seeding the stand. Sulphur is not required on irrigated soils.

The amount of nitrogen fertilizer applied will depend on the amount of nitrogen present in the soil and the amount removed by the growing crop.

• because grass seed heads generally ripen from the top down, when the tips begin to shatter, the crop is ready to harvest.

Generally, grass is swathed before combining because shattering losses are reduced by early cutting and drying in the swath. Grasses that shatter easily should be swathed in the early morning when air humidity is higher. Swathing problems to be aware of are:

• a light swath is difficult for the combine to pickup

• light rains may delay harvest

• the possibility of contamination of grass seed from weed seeds present in the swath

• a fluffy swath could be damaged from being blown by the wind.

Direct combining may be necessary when grass seed is very ripe. Some considerations for direct combining are:

• it may be necessary to dry the seed if moisture content is high

• the crop is in the field longer and bad weather conditions could possibly cause seed losses

• the harvest can be slower if green leafy foliage is present

Combine preparation

Harvesting light chaffy seed will require that the air intake be shut off; heavier grass seed will

need a small amount of air. Remove all sieves and chaffers except for the upper chaffer from the cleaning shoe. Open the chaffer enough for seed to drop through while allowing most of the straw to ride out. Chaffy seed will require a wider concave spacing than heavier seed. Run the cylinder only as fast as needed to free ripe seed. Cover or close completely the tailings rake or adjustable tailer to prevent material returning to the cylinder. In general, a concave spacing of 0.6 cm ($\frac{1}{4}$ in.) and a cylinder speed of 900 rpm is an adequate starting point but further adjustments may have to be made for harvest conditions.

If direct combining, position the sickle to cut at least 90 percent of the seed heads and avoid as much green foliage as possible. Travel fast enough to move material evenly to the cylinder and over the chaffer.

Seed storage

Seed can be stored safely in bulk at 10 to 12 per cent moisture or in bags at 12 to 15 per cent moisture. To maintain high germination, store seed under cool, dry conditions.

Post-harvest maintenance

Harvesting of most grass species is usually completed by mid-August. To maintain high seed yield, remove harvest residue from swathed fields immediately after harvest and before fall regrowth begins. The residue can be baled and used as animal feed. Removing harvest residue reduces disease potential and increases light penetration, which stimulates the production of more and larger tillers. If adequate moisture is available, treat the stand as an irrigated pasture and use moderate stocking rates. Since most perennial grasses initiate vegetative tiller buds in the fall, which determine the number of reproductive tillers the following year, do not graze to the point where plant crowns are damaged. Allow the stand to regrow to at least 15 cm (6 in.) before freeze-up.

Burning the residue may damage the newly-formed tillers in the crown. Also, the soil can be left unprotected resulting in either wind or water erosion.

Irrigate the grass stand after harvest to prevent drought injury. A heavy, late fall irrigation will help reduce drought injury during winter and provide moisture for early spring growth.

Taking Out The Grass Stand

The number of years of seed production will vary with the crop species. After the last seed crop has been harvested, the grass stand can be plowed out. The sod should be disked as deeply as possible before plowing. Plow about 13 cm (5 in.) deep and disk again once or twice to break up sod clumps. To conserve soil moisture and prevent wind and water erosion, leave the field rough over winter.

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1989 03 3M